Appendix E. Glossary

A

Adsorbed
Adhered to a surface, either chemically or electrostatically.

Algae
Plural of alga. Algae is a common term used to describe a highly variable group of photosynthetic organisms, often aquatic, that lack true stems, leaves, roots, and flowers. This term is applied to several taxonomic groups, including cyanobacteria.

Algaecide/Algaestatic
Compounds that kill or prevent growth of algae and cyanobacteria.

Allelopathy
The process of inhibiting competitors or grazers through the production of compounds.

Anatoxin-a (ATX)
A cyanobacterial toxin. This toxin is a bicyclic alkaloid that targets the central nervous system (neurotoxin). An analog (homoanatoxin-a) and derivatives have been identified. Anatoxin-a may be produced by species of, but not limited to, *Dolichospermum, Oscillatoria, Planktothrix, Phormidium*, and *Aphanizomenon*.

Anatoxin-a(s)
Now known as guanitoxin. This toxin was originally associated with *Anabaena*. This cyanobacterial toxin is a guanidine methyl phosphate ester that can target nervous systems (neurotoxin) by irreversibly binding to the acetylcholinesterase enzyme. It causes symptoms including excess salivation.

Aplysiatoxin
A cyanobacterial toxin. This toxin is considered to be a dermatoxin, as well as a potential carcinogen, based on primary impacts to the skin. Aplysiatoxins are produced by cyanobacteria including *Lyngbya, Schizothrix*, and *Oscillatoria*.

B

Bacteria
Bacteria are single-celled, microscopic organisms that lack cell walls and an organized nucleus (prokaryotes). They are found in every habitat on the planet. Some are photosynthetic.

Benthic
Refers to the bottom of lakes, rivers, and other water bodies. When referring to cyanobacteria, it means those that form mats on sediment surfaces, as well as those that attach to pebbles, cobbles, boulders, and other hard surfaces (for comparison, see Planktonic).

Best Management Practices (BMPs)
Strategies that are implemented on a landscape to reduce influx of nutrients, sediments, and other possible pollutants to local receiving waters.

Biomass/Biovolume
Respective mass or volume of cells in a unit volume of water (for example, mg/mL). Typically calculated to determine the relative abundance of co-occurring phytoplankton of varying shapes and sizes. Can be also quantified as a pigment such as chlorophyll or phycocyanin.

Bloom
A rapid proliferation of algae or cyanobacteria. In the case of cyanobacteria, it is also used to refer to dense accumulations of these populations, such as a wind-driven scum or benthic mats floating to the surface.

Blue-green Algae (BGA)
A historic term used to describe cyanobacteria. The blue-green color of certain species of cyanobacteria is due to the pigment phycocyanin, hence the common use of the term “blue-green algae.”

β-methylamino-L-alanine (BMAA)
Non-protein amino acid produced by some cyanobacteria that is hypothesized to be a neurotoxin linked to the development of neurodegenerative diseases. This hypothesis is still under investigation and has not been uniformly accepted by the scientific community.

Biological Oxygen Demand (BOD)
Biological oxygen demand is the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic conditions at a specified temperature.

C

Capping
The addition of a layer of material, such as sand or clay, to cover the bottom of a pond, lake, or reservoir to prevent resuspension of less dense fine particles, including flocculated (aggregated) and settled cyanobacteria.

Chlorophyll
The green pigment used for photosynthesis by all land and aquatic plants, algae, and cyanobacteria (for comparison, see Phycocyanin).

Clean Water Act (CWA), Section 303(d)
Section 303(d) of the CWA requires states to identify a list of impaired waters that do not meet an applicable water quality standard(s). This list, called a 303(d) list, is submitted to Congress every 2 years, and states are required to develop a Total Maximum Daily Load (TMDL) for pollutant(s) causing impairment for water bodies on the list.

Clean Water Act (CWA), Section 401
Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity that "may result in any discharge" into navigable waters must obtain a certification from the state or tribe in which the discharge originates that the discharge will comply with various provisions of the CWA. The federal license or permit may not be issued unless the state or tribe has granted or waived certification. The certification shall include conditions necessary to assure that the permit will comply with the state's or tribe's water quality standards or other appropriate requirements of state or tribal law. Such conditions must be included in the federal license or permit.

Clean Water Act (CWA), Section 404
Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States (including wetlands). A federal or state authorization is required through a nationwide, regional, general, or individual permit.

Colony/Colonial
A group of loosely or tightly associated, genetically identical cells that may exist as a unit in the environment.

Congener
Cyanotoxins with similar chemical structure and toxicological effects.

Cryptophyte
Photosynthetic, unicellular aquatic organisms found in both marine and freshwater environments.

Cyanobacteria
A group of photosynthetic prokaryotic microorganisms. Cyanobacteria are often referred to as *blue-green algae*, but they are taxonomically distinct from true algae or plants. Cyanobacteria are currently considered more similar to gram-negative bacteria.

Cyanocide/Cyanostatic
Compounds that inhibit cyanobacteria cell proliferation.

Cyanopeptides
Nitrogen-containing compounds similar to microcystin, but far less studied, that include cyanopeptolins, anabaenopeptins, microginins, aeruginosins, and aerucyclamide. Many of these compounds can inhibit cellular functions as frequently and at similar nanomolar concentrations in surface waters as more commonly known cyanotoxins.

Cyanotoxin
Toxin produced by cyanobacteria. These toxins include liver toxins (hepatotoxin), nerve toxins (neurotoxin), and skin toxins (dermatoxin). Also sometimes referred to as *algal toxin*.

Cylindrospermopsin (CYN)
Cyanobacterial toxins that are tricyclic alkaloids and considered to be hepatotoxins based on primary impacts to the liver. They may also be considered cytotoxins (lyses cells) due to impacts on other organs as well. Several congeners and analogs have been identified. Cylindrospermopsin may be produced by species of, but not limited to, *Cylindrospermopsis, Aphanizomenon, Chrysosporum, Umezakia, Anabaena, Dolichospermum, Microseira* , and *Raphidiopsis*.

D

Dermatoxin
Toxin with a primary target of the skin.

Designated Use
A legally binding definition that identifies an activity or purpose ("fishable/swimmable") for a water body. The identification of designated uses informs protection and management through federal, state, and tribal water quality regulations as

outlined in the Clean Water Act. Recreation, drinking water, and aquatic life uses are examples of common designated uses. States and tribes may also develop additional designated uses. To learn more, see Section 2 of the EPA Water Quality Standards Handbook:https://www.epa.gov/sites/production/files/2014-10/documents/handbook-section2.pdf.

Dimictic
A water body whose layers become evenly mixed twice a season and temperature and nutrient gradients from all layers become homogenous before layering out again.

Disinfection
The processes by which water is treated to remove pathogens to produce drinking water or treat wastewater. Three common disinfection methods include chlorine, ultraviolet light, and ozone. This is the stage where dissolved cyanotoxins can be destroyed in the drinking water treatment process.

Drain Field/Leach Field
The part of a septic system downstream of the holding tank that distributes nutrient-enriched wastewater from the holding tank to the underlying soil.

E

Ecosystem Service
Benefits that humans receive from nature.

Enzyme-linked Immunosorbent Assay (ELISA)
Quantitative antibody- or antigen-based tests, including those for cyanobacterial and algal toxins.

Enumeration
Laboratory method in which microscopic organisms, including cyanobacteria, are quantified by microscopy. Results are usually reported as cell densities (cells/mL) but may also be reported as natural units per unit of volume, such as colonies, filaments/trichomes, or single cells that are an organism's usual growth form.

Epilimnion
A well-mixed, less dense layer of water near the surface in thermally stratified water bodies. It generally overlies denser, colder waters.

Eukaryotic
Referring to organisms, either microscopic or macroscopic, that have a membrane-bound nucleus and organelles (for comparison, see Prokaryotic).

Eutrophication
The increase in nutrients (nitrogen, phosphorus, trace materials) in a water body that leads to excessive growth of algae or cyanobacteria.

Exopolysaccharide (EPS)
See Mucopolysaccharide.

External Loading
Nutrients that reach a water body from other sources in the watershed, known as external sources (for comparison, see Internal Loading).

Extracellular
Present outside cells. In this document, *extracellular* is typically used in reference to cyanotoxins that have been released from cells (for comparison, see Intracellular).

F

Filament
Also known as *trichome*. A filament is formed by single algae cells that are joined to create a chain or filament. A common morphology of many cyanobacteria, including *Anabaena, Dolichospermum, Aphanizomenon, Cylindrospermopsis*, and many others.

Flocculation
The process of aggregating suspended cells through the addition of inorganic ballast (clays, soils) coated with a surfactant (binding agent) that induces cells to stick to the particles and sink out of the water column.

G

Gas Vesicles
Gas-filled structures in some prokaryotes that can regulate buoyancy.

Glutaraldehyde
A potent solution used to preserve field and laboratory samples for microscopy, such as samples for cyanobacteria identification and enumeration.

Guanitoxin (GNT)
Currently proposed name for the neurotoxin originally named anatoxin-a(s).

H

Harmful Cyanobacterial Bloom (HCB)
A rapid proliferation of cyanobacteria where there is an elevated risk to human or animal health due to the production of cyanotoxins and other cyanobacteria-related effects. It is also used to refer to dense accumulations of cyanobacteria, such as a wind-driven scum or populations at depth, including those on the bottom (benthic mats) that may float to the surface.

Hepatotoxin
Toxin with a primary target of the liver. For cyanotoxins, the most common example is microcystin and its congeners.

Heterocyte
A specialized nitrogen-fixing cell formed by some cyanobacteria. Nitrogen fixation is very sensitive to oxygen, and the heterocyte structure creates an oxygen-free space. May also be referred to as a heterocyst in some cyanobacterial literature.

Hydromodification
The alteration of the natural flow of water through a landscape, such as changes in land use or cover. It also often takes the form of stream or lake modification, such as channelization or dams.

Hypolimnion
A dense, cold layer of water near the bottom of thermally stratified water bodies where biotic and chemical processes may result in oxygen depletion and internal loading of nutrients.

I

Internal Loading
The release of nutrients from sediments within a water body. Nutrients from external sources may be taken up by organisms and incorporated into their cells or may sink and be held in the sediment by chemical processes. Dead algal cells can also settle and contribute to the sediment nutrient load. Under certain conditions, usually low oxygen levels at the sediment surface or extreme pH levels, nutrients can be released from the sediment to the water column (for comparison, see External Loading).

Intracellular
Present within cells. In this document, typically used in reference to cyanotoxins within cyanobacterial cells (for comparison, see Extracellular).

J

K

L

Legacy Nutrients
Surplus nutrients that have accumulated over a long period of time, such as those retained in groundwater and lake sediments (see also Internal Loading).

Lipopolysaccharide (LPS)
Large molecules containing a lipid and a polysaccharide that are a component of the outer membrane of mainly gram-negative bacteria and cyanobacteria. These molecules may cause irritation to the skin, eyes, ears, and gastrointestinal system.

Lugol’s Solution
An aqueous solution of iodine and potassium iodide that is used as a fixative for staining and short-term storage of phytoplankton samples for microscopy. For longer term sample storage, a preservative like glutaraldehyde or formaldehyde should be added.

Lyngbyatoxin
A cyanotoxin that is a potential carcinogen and a known dermatoxin. Lyngbyatoxins are produced by cyanobacteria

including *Lyngbya*.

Lyse (Lysed, Non-lysed)
To lyse a cell is to disrupt a cell membrane and therefore destroy a cell, releasing its contents into the environment.

M

Memorandum of Understanding (MoU)
A formal agreement between two or more parties. In the context of HCBs, an MoU is often used to clarify roles and responsibilities for responding to HCB incidents and other environmental interventions.

Meromictic
Term used to describe lake waters in which layers do not intermix. Physical mixing or seasonal turnover does not occur in water bodies described as meromictic.

Metalimnion
In a stratified lake, the middle layer of water where temperature decreases rapidly with depth (thermocline). This layer prevents mixing of the upper, warmer epilimnion layer and the lower, colder hypolimnion layer. It acts as a barrier for oxygen diffusion from the surface downward and nutrient diffusion upward.

Microcystin(s) (MCs)
These cyanobacterial toxins are monocyclic heptapeptides and considered to be hepatotoxins, based on primary impacts to the liver. Globally, microcystins are the most commonly occurring cyanobacterial toxins. As of 2020, more than 200 congeners (variants with different accessory amino acids) of microcystin have been identified. Microcystins are abbreviated as MC- followed by two letters designating the congener name—for example, MC-LR, which contains leucine (L) and arginine (R). Microcystins are produced by many cyanobacteria, including but not limited to species of *Microcystis, Dolichospermum, Nodularia, Planktothrix, Fischerella, Nostoc, Oscillatoria*, and *Gloeotrichia*.

Monomictic
Water bodies that experience a mixing from top to bottom during one defined seasonal mixing period (e.g., fall or spring turnover events).

Mucopolysaccharide (MPS)
Compounds secreted by cyanobacteria in which some colonial forms grow or form sheaths around some filamentous forms; can also be referred to as exopolysaccharide (EPS).

N

Neurotoxin
Toxin with a primary target of the nervous system. The four major neurotoxic cyanotoxins (with their variants) are anatoxin-a, guanitoxin/anatoxin-a(s), saxitoxin, and possibly BMAA. Several producers include *Cylindrospermopsis, Anabaena, Dolichospermum, Planktothrix, Aphanizomenon, Lyngbya*, and *Raphidiopsis*.

Nitrogen Fixation, Fix Nitrogen
The process by which gaseous molecular nitrogen from the air is converted into ammonia or related compounds that can be used for growth (called fixed nitrogen). Biological nitrogen fixation is carried out by very few cyanobacteria and nitrogen-fixing bacteria, and most other organisms depend on nitrogen fixers for fixed nitrogen.

Nonpoint Source
These sources of pollutant loading do not have a clearly identifiable source of nutrients that are delivered to a water body. Typically, these are delivered as diffuse leakage or runoff across a broad area. Any source that does not meet the legal definition of a “point source” is defined as a nonpoint source (for comparison, see Point Source).

P

Pelagophyte
A specific group of algae with two flagella. In this document, it refers to the “brown tide” organism *Aureococcus anophagefferens*, a 2 µm cell that blooms in coastal lagoons.

Photic Zone
The uppermost part of a water body that receives sunlight, allowing the growth of photosynthetic organisms.

Photosynthesis/Photosynthetic
The biochemical process in which cyanobacteria, algae, and plants use solar energy to convert carbon dioxide and water to carbohydrates and oxygen.

Phycocyanin Pigments/Phycocyanin

Blue-green, water-soluble pigment that gives *blue-green algae*, or cyanobacteria, their name. Phycocyanin is an accessory pigment that assists the chlorophyll molecule in capturing light for photosynthesis.

Phycoerythrin
One of several accessory pigments that assist the chlorophyll molecule in capturing light for photosynthesis. They are found in some cyanobacteria, as well as cryptophytes and red algae.

Phytoplankton
A general term referring to the small photosynthetic organisms floating in open areas of water. Phytoplankton may be unicellular or multicellular and prokaryotic or eukaryotic. Phytoplankton communities commonly include cyanobacteria and algae.

Plankton/Planktonic
Organisms that live in open water bodies and drift by the tides, currents, and wind (for comparison, see Benthic).

Point Source
Clearly identifiable conveyors of a pollutant to a water body, as defined in the Clean Water Act. Typically, it is a managed wastewater flow released to the environment by a pipe or other distribution system. Many point sources are managed under the National Pollutant Discharge Elimination System permitting (for comparison, see Nonpoint source).

Prokaryotic
Referring to microscopic, single-celled organisms lacking a membrane-bound nucleus and organelles. Includes bacteria and cyanobacteria (for comparison, see Eukaryotic).

R

Remote Sensing
The use of satellites, airplanes, drones, buoys, floating sensor packages, or underwater data collectors to observe and obtain information about the Earth's surface and aquatic systems.

Respiration
The physical and chemical processes that produce energy in living cells. An electron acceptor, such as oxygen, is needed for this process, and waste products, such as carbon dioxide, are produced. Though cyanobacteria produce oxygen through photosynthesis during the day, they also respire and can rapidly remove oxygen from the water at night when very large blooms are present.

Risk Communication
The formal and informal process of communication among and between regulatory agencies and organizations responsible for risk assessment and management and the various parties who are potentially at risk from or are otherwise interested in the information. Risk communication includes actions, words, and other messages that are responsive to the concerns and values of its recipients, and it is intended to help people make more informed decisions about threats to their health and safety.

S

Saxitoxin (STX)
Cyanobacterial toxins that are highly polar, nonvolatile, tricyclic perhydropurine alkaloids. They target the central nervous system (neurotoxins) by binding to sodium channels. Also known as paralytic shellfish poisons/toxins (PSP/PST), as these toxins can accumulate in marine shellfish and cause paralytic shellfish poisoning in humans that consume them. These toxins are produced by dinoflagellate algae (typically in marine systems) and by cyanobacteria in freshwater systems. Freshwater producers may include *Anabaena, Aphanizomenon, Planktothrix, Cylindrospermopsis, Lyngbya* and *Scytonema*.

Source Water
Groundwater or surface water body that provides water to public drinking water supplies or private wells. For public drinking water, surface-sourced water (and some groundwater under the influence of surface water) requires filtration, disinfection, and other treatment, and finished water is distributed to consumers. Regulation of public water suppliers is mandated through the federal Safe Drinking Water Act.

Sp./Spp.
Abbreviations for a single species (sp.) or multiple species within a genus (spp.).

Stratification/Stratified
The division of the vertical water column into distinct layers of different densities due to variations in salinity and temperature. Stratification due to temperature is referred to as thermal stratification, frequently observed in deep lakes. The warmer waters, being less dense, are found near the surface (epilimnion). The colder, denser waters are found at the bottom

(hypolimnion). The epilimnion and hypolimnion are separated by a distinct, thin layer of water called the metalimnion or thermocline, where the temperature changes more rapidly than in the overlying and underlying waters. While each vertical layer is well mixed in itself, the different layers do not intermix, resulting in variations in water quality in the surface and bottom water. For example, the epilimnion could be oxygen rich during the summers, while the hypolimnion could be devoid of oxygen at the same time. The sunlit near-surface warm water (photic zone) generally supports phytoplankton photosynthesis and elevated concentrations of dissolved oxygen. Oxygen concentrations decline below the thermocline due to less light and lower photosynthesis or darkness and no photosynthesis, leading to bacterial decomposition consuming the available oxygen. The low oxygen, in turn, results in high release of nutrients from bottom sediments and accumulation below the thermocline (see also Internal Loading). The thermocline acts as a barrier for oxygen diffusion from the surface downward and nutrient diffusion upward. Cyanobacteria can control their buoyancy and migrate up in the day for surface light and down at night for near-thermocline nutrients, giving them a unique competitive advantage over many other phytoplankton.

Surfactant
A compound added to induce aggregation of particles by reducing the surface tension between them, such as polyaluminum chloride or chitosan. These help in flocculating particles, including cells.

T

Taste and Odor Compounds
Several cyanobacteria and some diatoms produce compounds that impart unsavory taste and odor to drinking water or fish tissue, including geosmin and methylisoborneol. These compounds often require substantial treatment modifications in drinking water facility treatments.

Taxon
Singular term for a unified group of organisms, the plural being *taxa*. Algal and cyanobacterial taxa are typically referred to by genus or species, but higher ranks for all species include Kingdom, Phylum/Division, Class, Order, and Family.

Taxonomy (Taxonomist)
The science of classifying and identifying organisms into specific categories based on internal and external morphologies and, more recently, genetic information.

Thermocline
A thin, distinct layer of water between the well-mixed upper and lower waters (the epilimnion and hypolimnion, respectively) in a thermally stratified water body (see also Metalimnion).

W

Water Quality Standards (WQS)
Provisions of state, territorial, authorized tribal, or federal law approved by USEPA that describe the desired condition of a water body and the means by which that condition will be protected or achieved. See the USEPA website for more information on developing WQS at https://www.epa.gov/standards-water-body-health/what-are-water-quality-standards. USEPA's Water Quality Standards Academy is a free online tool to help you understand the key concepts of the Water Quality Standards:https://www.epa.gov/wqs-tech/water-quality-standards-academy.